124

SYLLABUS

OF A

Courſe of Lectures

ON

NATURAL and EXPERIMENTAL PHILOSOPHY,

VIZ.

ASTRONOMY,
Uſe of the GLOBES,
PNEUMATICS,
ELECTRICITY,
MAGNETISM,
CHEMISTRY,
MECHANICS,
HYDROSTATICS,
HYDRAULICS,
ENGINEERING,
FORTIFICATION,
OPTICS, *&c.*

By *A. WALKER.* K

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BRITISH MUSEUM

SYLLABUS

Of a COURSE of LECTURES

ON

Natural and Experimental *PHILOSOPHY*.

THIS extenſive Courſe conſiſts of all the moſt curious, uſeful, new and entertaining parts of Philoſophy; 'tis an Epitome of the whole Œconomy of the Univerſe, as well as of the more familiar Parts of Nature, and very agreeably ſets before the inquiſitive Mind the moſt uſeful Productions of human Art and Enquiry: and as the terms are explained, and no ſtile affected but that of Simplicity and plainneſs, 'tis humbly preſumed that the courſe is intereſting to, and may be comprehended by, all ranks and ſtations in life; and is particularly adapted to ſuch gentlemen and ladies as would chuſe to be acquainted with the moſt rational and ſublime parts of knowledge, in the moſt eaſy manner, and at the leaſt expence. The courſe conſiſts of twelve lectures; and the apparatus is the whole of that juſtly celebrated ſet of inſtruments collected by Mr. Griffith, the lecturer, beſides a great variety added to them by the preſent Proprietor; and before this addition they were eſteemed, by the profeſſors in both univerſities, the moſt compleat, extenſive, and valuable collection in Great-Britain.

To enumerate the whole of this apparatus would far exceed the bounds of a ſyllabus——but a few of its particulars are theſe, viz. The grand orrery, much improved. A tranſparent orrery, more like nature than any thing of the kind (invented by the author.) Variety of new-conſtructed globes, ſpheres, planetariums, cometariums, &c. The whirling tables. Air pumps. Magazine and walking cane wind-guns. Condenſers, &c. Reflecting, refracting, and patent teleſcopes. All kinds of mirrors and deceptions. Lenſes, &c. The artificial eye and ear, lungs, thorax, and diaphragma. Solar and double microſcopes. Camera obſcura. Diagonal mirrors. Opera glaſſes. Magic lanthorns, &c. Dr. Halley's improved diver's bell. All kinds of ſyphons, fountains, and ſpouting pipes. The hydroſtatic paradox, and variety of new methods of proving the upward, downward, and lateral preſſure of water. Tide-tables and other machines, invented by Mr. Ferguſon. The pyrometer. The electrical machine, greatly improved—the electrical battery, thunder-houſe, &c. Loadſtones, and all kinds of magnets. All the mechanical powers, with working models of various cranes, pumps, water-mills, pile-drivers, engines, plows, carts, coaches, ſhips, the centrifugal machine, and a working fire engine, for draining mines, of the lateſt conſtruction. Alſo another working fire-engine, which, by means of an inverted piſton, will do the ſame work at about two thirds the expence. Alſo another working model for the ſame purpoſe, which ſaves the expence of fire, by forming the vacuum with cold water; and Blakey's patent engine. Likewiſe a new-contrived bucket-engine, which works with a remarkably ſmall quantity of water; and a windmill which, by cloathing and uncloathing itſelf, moves with the ſame velocity in high or low winds. An horizontal wind-mill, invented by Joſeph Henry, Eſq. Working models alſo of the Duke of Bridgewater's curious canal and colliery near Mancheſter; and alſo a machine that will raiſe water to any height to ſupply gentlemen's houſes, towns or villages, without the aſſiſtance of wind, fire, water-wheel, man, or beaſt, &c. The lectures will alſo be enlivened by a new muſical inſtrument, contrived by the author, which he calls the CELESTINA, which has all the perfections of the organ, harpſichord, piano-forte, harmonica, or viol d'amour.

The lectures require about two hours attendance every day, except Sunday, for a fortnight, and will begin as ſoon as forty or more have ſubſcribed; one guinea a gentleman's transferrable ticket, half a guinea a lady's, to be paid at the firſt lecture, when the hours of attendance for the future lectures will be fixed agreeable to the majority of the ſubſcribers.

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Heads of each Lecture.

LECTURE I. *General Properties of Matter.*

1. EXordium, explaining the uſes of philoſophical inquiries in arts, trade, agriculture, the knowledge of the Deity and Ourſelves.

2. The ſimple elements, what.—Matter infinitely diviſible.—Impenetrably hard.—Inert. All proved by many new and curious experiments.

3. Attraction of coheſion.—Repulſion.—Solidity and fluidity, what.—How matter, differing in its mode of coheſion, gives that infinite variety of properties in the animal, vegetable, and mineral worlds.—How vegetation, ſecretion, digeſtion, and abſorption is performed.

4. Original particles of matter of the ſame weight proved by the guinea and feather.

5. Elective attractions defined by affinities, ſolutions, precipitations, &c.

6. Magnetiſm. Its hiſtory, properties, mode of communication, and deprivation, explained by new and uncommon experiments.—How and when applied to navigation.—The needle's variation, with Dr. *Halley*'s opinion of its cauſe.—Beſt methods of making artificial magnets, and preſerving their attraction.

7. Electrical attraction and repulſion explained.

8. Definition of fire, its properties and effects; what are good and bad conductors of it; hence the reaſon of cold produced by mixtures, evaporation, &c. and that heat expands and cold contracts every kind of body. The pyrometer, eolepile, thermometer, &c. are included in the above definitions.

LECTURE II. *MECHANICS.*

1. THE *Attraction of Gravitation* explained by the figure of the earth—falling bodies—planetary motion, &c.

2. *Center of Gravity*—defining why leaning bodies do not fall—why bodies may be ſuſpended on a point—and why others may appear to roll upwards.

3. *Laws of Motion*—ſhewing how two contrary motions produce a third.—How ſwimming, flying, ſhooting is performed.—How curves and projectiles are generated; and how theſe laws keep the planets in their orbits.

4. The momentum of a ſtroke, or falling body, explained and calculated.—Percuſſion and reſiſtance, what.—Pendulums and time-keepers ſet in ſeveral lights; and why ſo deſireable for finding out the longitude at ſea.

5. How what we gain in power is loſt in the time of working any machine; and how its momentum or force is calculated.

6. The lever, wheel, axle, pulley, inclined plane, wedge and ſcrew, explained by various models and experiments, and their united power defined by a machine compoſed of them all.

7. Friction, of both kinds, what.—Surfaces and preſſure, how they add to, or diminiſh, friction.—Friction-wheels or rollers, how applied to mills, engines, wheel-carriages, &c. and how much rubbing, or friction, takes from the power of all machines whatſoever.

LECTURE III. *FORTIFICATION, MACHINES,* &c.

1. DISSERTATION on the ſtate of nature and civil ſociety.—On the policy of artificial wants;—the ſource of trade and population;—the propenſity of our nature to be governed by faſhions, cuſtoms, and habits, and the uſe made of them by deſigning Kings and Governors.

2. Thoſe phenomena in our nature that firſt dictated ſubordination, warfare, defence, and fortification.—Hiſtory of their riſe, progreſs, and preſent ſtate.

3. An elegant model of a fortification, and its out-works explained.

4. An explanation, by working models, of the common pile-driver.—*Voulou*'s pile-driver for *Weſtminſter* and *Blackfriars* bridges.—A ſaw-mill.—A wind-mill with an equable motion, and that turns itſelf to the wind.—Mr. *Henry*'s horizontal wind-mill.—Mr. *Craik*'s drill-plough, that ſaves one third of the ſeed, rolls the ground, and harrows it at the ſame time.—A ventilator of a new conſtruction, that takes out corrupt air from hoſpitals, ſhips, ſick-rooms, or cellars, and pours in a current of freſh air.—Carts, waggons, coaches, &c. the advantages and diſadvantages of their preſent conſtruction.—Broad and narrow wheels, friction wheels, high and low wheels, diſhed wheels, teams, and ſingle-horſe carts conſidered.—How beſt to apply animal ſtrength.—Shoeing and yoking horſes, &c.—A fire or ſteam engine, with an inverted piſton, that works without a beam or building, and with a ſmall quantity of fire.—Another, having the vacuum formed by cold water without any fire.

LECTURE IV. *PNEUMATICS.*

1. THAT the air is a body, proved by a new-conſtructed diver's bell, with air veſſels, &c. and by birds and quadrupeds let down into water without being hurt.

2. That the air gravitates, or has weight, proved by its forcing the hand down, and faſtening it to the top of a receiver:—By its being weighed in a balance:—By its forcing water into an exhauſted bolthead:—By a fountain in vacuo:—by its forcing quickſilver thro' the pores of wood:—By its burſting bottles, bladders, &c.—By the *Torricellian* experiment:—And by the exhauſted hemiſpheres.——In the courſe of theſe experiments it will appear how air and water *diſſolve* or *imbibe* one another—how vapours riſe into, and fall from, the air—the reaſon of the riſe and fall of the quickſilver in the barometer or weather-glaſs; and why it foretells rainy or fair weather.

3. That there is no ſuch principle in nature as ſuction, proved by a veſſel being faſtened to the pump-plate without being near the place from whence the ſucking quality (if any) muſt proceed:—By a water-pump acting in vacuo:—By transferring air from one veſſel to another, at a diſtance from the air pump:—By the cupping glaſs, and by the artificial mouth of a ſucking child.

4. That the air has a ſpring, or an elaſtic quality, and can occupy a greater ſpace than what it naturally poſſeſſes—proved by an inch

inch of air ſwelling to a prodigious ſize :—By the ſwelling of the air in a wither'd apple, making it appear plump and freſh :—By the air in an egg, forcing out the reſt of its contents :—By taking air viſibly out of gold :—By its lifting great weights :—Making a fountain, forcing quickſilver, &c. ſhewing this ſpring equal to its preſſure or weight.

5. Boiling defined, by making the ebulition of boiling with the ſmalleſt quantity of fire.

6. Definition and reaſon of winds ;—irregular, periodical, or partial, viz. trade winds, monſoons, day and night breezes, ternadoes, drafts, buzzing, &c.

LECTURE V. *PNEUMATICS.*

1. THAT the air is capable of being compreſſed, proved by forcing air upon a blown bladder and ſhriveling it up : By many curious fountains, and by the magazine and walking cane air-guns.

2. That the air is the vehicle of ſound, proved by firing gunpowder and making a clock ſtrike in vacuo.—Hence the theory of ſound, echo, muſical chords, muſical inſtruments, &c.

3. Deſcription and diſſection of the human ear.

4. That the air is a menſtruum for water, proved by evaporations; artificial ſhowers, &c. Hence the doctrine of rain, hail, and ſnow.

5. That the air is filled with an heterogeneous aſſemblage of the ſmall particles of all kinds of bodies, and that it attracts and precipitates like all other chemical menſtruums—proved by artificial inflammable and ſuffocating damps—by the ſeeds and farina of plants being carried abroad in it—by infections and epidemical diſtempers—and by its diſſolution of the mephetic matter in the lungs. Hence are pointed out the diſorders occaſioned by breathing corrupt and ſaturated air, and the evils ariſing from ſitting in low, ſmall, or cloſe rooms.

6. That the air lies in a fixed ſtate, and is a conſtituent part of all animal, vegetable, and mineral ſubſtances—proved by a cure for the ſcurvy—by making magneſia—and by reſtoring fixed air to quick-lime, and thereby reducing it back to a lime-ſtone.

7. How animals are affected in vacuo—proved by artificial lungs and a live animal put in a receiver.

8. Diſſection of the air-pump.

LECTURE VI. *HYDROSTATICS.*

1. THAT water is a porous fluid—proved by various ſolutions, and decompoſitions of acid, alkaline, mineral, and medicinal waters.

2. How far compreſſible and hard—proved by the *Florentine* and Mr. *Canton*'s experiments,—the pulſe glaſs, &c.

3. That it preſſes in all directions alike, according to its perpendicular height—proved by pillars of particles—ſpecific gravities—hydrometers—by lead made to ſwim, and cork to ſink—by a new experiment to ſhew how much its preſſure is againſt banks, floodgates, ſides of perpendicular pipes, tops of drains, &c.—by the hydroſtatic paradox—by ſwimming—by *Faux*'s figures—by the bed made in water by a ſhip—and by fountains.

4. What ſolids heavier than water loſe by being immerſed in it, proved by weighing lead, braſs, gold, &c. in air and water—by the alloy found in King *Hiero*'s crown, and in *Engliſh* and foreign coin.

5. The nature and uſe of cranes and ſyphons—explained by decanting fluids out of bung-holes, wells, *Tantalus*'s cup, intermitting ſprings, &c. Hence the doctrine of fountains, brooks, rivers, &c.

LECTURE VII. *HYDRAULICS.*

1. THE doctrine of ſpouting fluids—proved by their effect on water-wheels in lifting weights, &c. by the moſt approved methods of applying water to wheels—beſt angle for horizontal ſpouting—and by the ratio of tapping an head of water.

2. Pipes of conduct, what—mode of application.

3. Working models of *Archimedes*'s ſcrew-pump.—Houſhold or ſucking pump.—Force pump and extinguiſhing engine.—Lifting pump—(beſt way of applying manual ſtrength to them.)—Square pump, with a pyramidal piſton (peculiarly adapted to draining.)—Centrifugal pump, that forms the vacuum by a whirling motion.—*Martin*'s patent pump, that works without friction, and raiſes twice the uſual quantity of water.—Bucket engine to ſupply houſes or towns with water.—Another for draining mines, of vaſt power and ſimplicity.—Dr. *Barker*'s cylindrical mill, that gives motion to the ſtones without wheels, cogs, or rungs.—*Blakey*'s patent fire or ſteam engine.—Duke of *Bridgewater*'s curious canal and colliery nigh *Mancheſter*.

LECTURE VIII. *ELECTRICITY.*

1. HIſtory and preſent ſtate of diſcoveries in electricity.

2. Electric and non-electric ſubſtances exhibited by various experiments on conducting and non-conducting ſubſtances.

3. Nature of points and round bodies in receiving and parting with electricity—proved by ſparks taken by them—by mills made to move by the electrical effluvium iſſuing from a point—by the feather experiment—and by the wires for preventing damage by lightning.

4. Electrical

4. Electrical attraction and repulſion proved by Dr. *Franklin's* golden fiſh—by the ſhower of bran, ſmall ſeeds, &c.—by the dancing of magic figures, down, feathers, &c.—by *Rackſtrow's* experiment—and experiments made with the electrometer.

5. Theory of negative and poſitive electricity—proved by the electrical flaſh—by the electrical circuit—the electrical ſhock—by vials and batteries—and by lightning.

6. Nature and reaſon of lightning, earthquakes, aurora borealis, luminous appearance of the ſea in a ſtorm; why more water falls at the bottom than the top of a building; why ſteeples are ſo liable to be ſtruck by lightning, and how prevented; how animals are kill'd by lightning and the electric ſhock, and how moſt rationally prevented.—Each of theſe proved by many new and ſtriking experiments on artificial clouds and ſhowers; houſes ſtruck by accumulated electricity; animals killed by it; firing ſpirits, gunpowder, fire-work, and cannon with it; beatifications; increaſing the motion of the pulſe, &c.

☞ An electrical kite will be taken into the fields if deſired.

LECTURE IX. *OPTICS.*

1. VArious inſects, ſeeds, farina, pores in roots and branches of plants, animalculæ in various fluids, circulation of the blood, effervesſcences, diſcharging fixed air, &c. &c. exhibited in a curious ſolar microſcope.

2. Light, what it is, and how affected by paſſing in and out of different mediums, proved by various experiments on a ray of light with air, water, glaſs, lenſes, priſms, &c. ſhewing how light is the occaſion of viſion, how and why it is condenſed in burning glaſſes and dilated by concave lenſes; why convex lenſes magnify objects, and concave diminiſh them; why the picture of objects on the retina of the eye are inverted, and why ſeen upright; why the priſm exhibits various colours; reaſon of colours in general, the rainbow, blue-ſky, colours in bubbles, thin lamina, &c.

3. Theory of the reflection of light, and the angles of incidence and reflection, proved by experiments on plane, convex, concave, and cylindrical mirrors; ſhewing why the image in a plane glaſs is twice the diſtance of the object; why the whole perſon can be ſeen in a glaſs but half its length; why concave mirrors enlarge and convex diminiſh objects; diſtortion, anamorphoſis, &c. explained, by paintings ſeen in concave and convex cylindrical mirrors.

4. Deſcription and diſſection of the reflecting, refracting, and patent teleſcopes; ſolar, double, ſingle, and field microſcopes; opera glaſſes, diagonal mirrors, magic lanthorns, camera obſcura, ſcyoptric ball, &c.

[illegible] Deſcription and diſſection of the eye, the uſes of all its parts, and the whole doctrine of viſion, proved by ſeveral artificial as well as natural eyes; how that noble organ is beſt preſerved, and how aſſiſted in ſhort-ſighted young and old people.

LECTURE X. *ASTRONOMY.*

1. TRUE figure of the earth proved by obſervation and menſuration, and illuſtrated by globes, planetariums, orreries, &c.

2. How the different ſeaſons are produced; day and night; long and ſhort days; heat of ſummer and cold of winter.

3. Antipodes illuſtrated by globes, drawings, and the terella.

4. Why we perceive not the earth's motion; and how the moſt ignorant may be convinced, even by occular demonſtration, that it is the earth and not the ſun that turns round every twenty-four hours, and alſo how the earth turns round the ſun in twelve months.

5. How little the higheſt mountains affect the round figure of the earth, and why the ſea appears flat even to a ſpectator on the higheſt eminence.

6. How and why aſtronomers diſtinguiſh the ſurface of the earth and heavens by lines and circles, viz. meridians, latitudes, horizon, equator, tropics, eclyptic, ſigns, conſtellations, declinations, &c.

LECTURE XI. *ASTRONOMY.*

1. GEneral theory of the moon.

2. Its phaſis explained on the orrery, viz. why it appears horned, gibous, and full.

3. Solar and lunar eclipſes, what—how occaſioned—why ſo ſeldom—and how calculated.

4. Why the moon appears ſo much larger at her riſing than on the meridian;—why ſhe riſes in the harveſt full every evening near the ſame time for a week together;—why ſhe ſhines for a fortnight, without ſetting every lunation, alternately on the frigid zones.

5. How the earth and moon affect each other, and turn round the common center of gravity; how tides are occaſioned; the current of the gulph of *Florida*, *Gibraltar*, &c. the ſmall tides of the *Weſt-Indies*; rapid and high tides of the *Thames* and *Severn*; the equinoctial tides, and the tides of the air.

6. Preſumption that the moon is a world; diſſertation on her motion, ſeas, continents, mountains, and how the earth muſt appear to her inhabitants.

LECTURE

LECTURE [illegible]—*ASTRONOMY.*

1. P*Tolomaic*, *Tychonic*, and *Copernican* ſyſtems, what.

2. Planetary motion by *Deſcartes'* vortexes exploded.

3. *Newtonian* doctrine of centrifugal and centripetal motions explained by curious experiments on the whirling tables, and applied to the explanation of the planetary motion ;—*Keplax's* problem—and the correſpondence of areas and times ſolved by them.

4. Diſſertation on, and probable cauſe of, the flood—deduced from the ſhells and fiſh bones found on mountains—from the arrangement of mountains—the breaks in mines—the dipping ſtrata of the earth, &c.

5. Deſcription of each planet in the ſolar ſyſtem, its motion, appearances, and moons ; in the courſe of which will be given a familiar doctrine of paralax—how the diſtance of the heavenly bodies are found—what advantages the world may derive from obſervations on the late tranſit of venus ;—what is meant by the equation of time ;—the preciſion of the equinoxes ;—the longitude found by Jupiter's ſatellites ;—the retrograde motion of the planets, &c.

6. Diſſertation on comets and the univerſe of ſyſtems.

7. Recapitulation of the whole.

N. B. An epitome of the lectures, to aſſiſt the memory, ſold in the room, price one ſhilling.

Noblemen, or others, may have this courſe read at their own houſes, on eaſy terms.——Uſe of the globes taught, &c.

The E N D.